Title: Laboratory Overview

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Intended for: Ratoff Visit, 2018-11-15 (LOS ALAMOS, New Mexico, United States)

Issued: 2018-11-15

Los Alamos
NATIONAL LABORATORY
EST. 1943

Laboratory Overview

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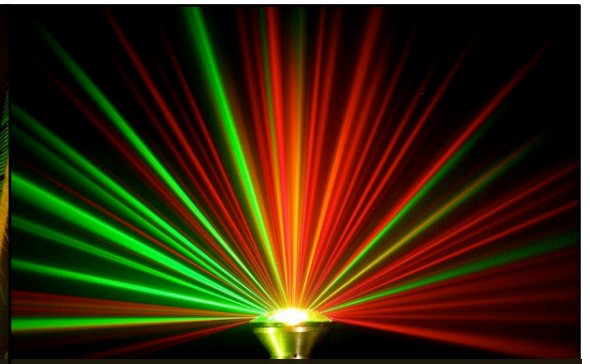
Nov. 15, 2018

NNSA
National Nuclear Security Administration

Los Alamos' core mission is to ensure the U.S. nuclear deterrent

- Ensure safety, reliability, and performance of U.S. nuclear stockpile
- Design agency for four out of seven warhead systems constituting nation's deterrent
- Modeling, simulation, radiography, and non-nuclear testing provide assurance

Modeling & simulation



Specialized experiments

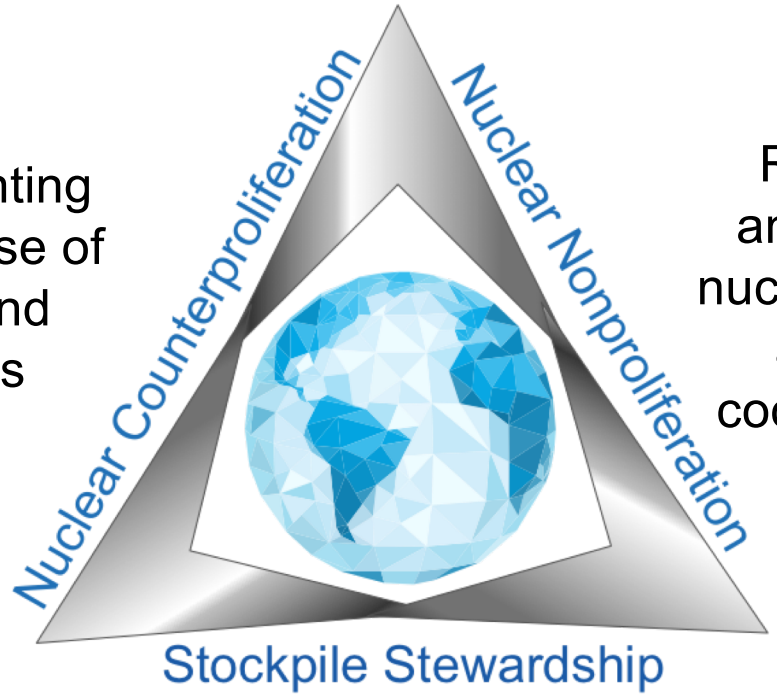
Supercomputing

DARHT – Dual axis X-ray

Los Alamos uses scientific assessment, experimentation, & modeling to assess and certify the stockpile, which has aged significantly since it was first developed and since the conclusion of full-scale testing

Los Alamos' broader national security missions comprise strategic deterrence

Detecting and preventing the development or use of nuclear weapons and improvised devices



Reducing nuclear arms and limiting the spread of nuclear technology, material, and expertise through cooperation and diplomacy

Providing the foundation for global security programs through theory, modeling and simulation, and experimentation

Intelligence, Defense and Counterterrorism
Nuclear Counterproliferation
Emerging Threats
Nuclear Nonproliferation and Security

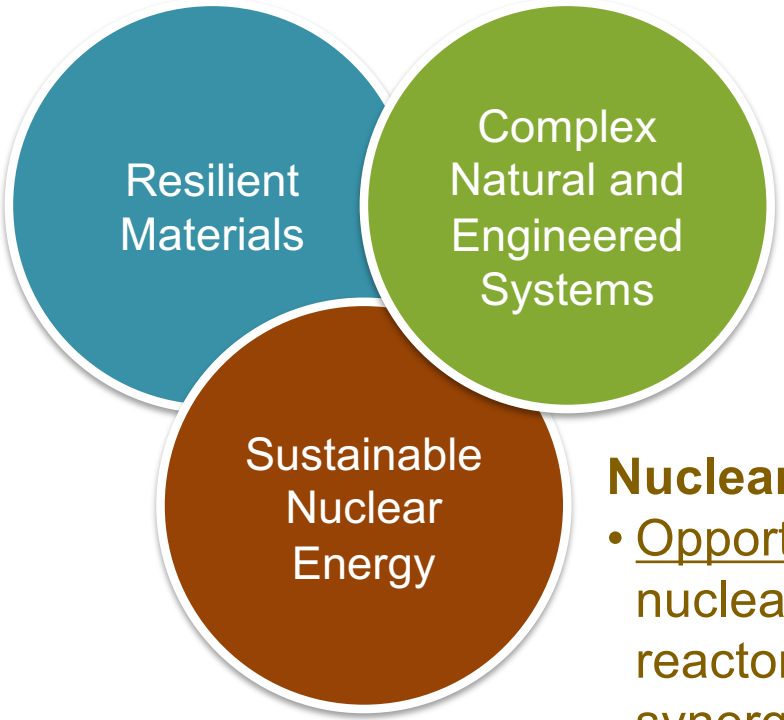
"…energy security is national security" – LGH, 4/6/18

Grid security/reliability/resilience

- Opportunity: Budgets, DOE reorg, strong LANL capabilities, overlap with national security

Materials

- Opportunity: Growth in fuel cells and related programs



Fossil energy

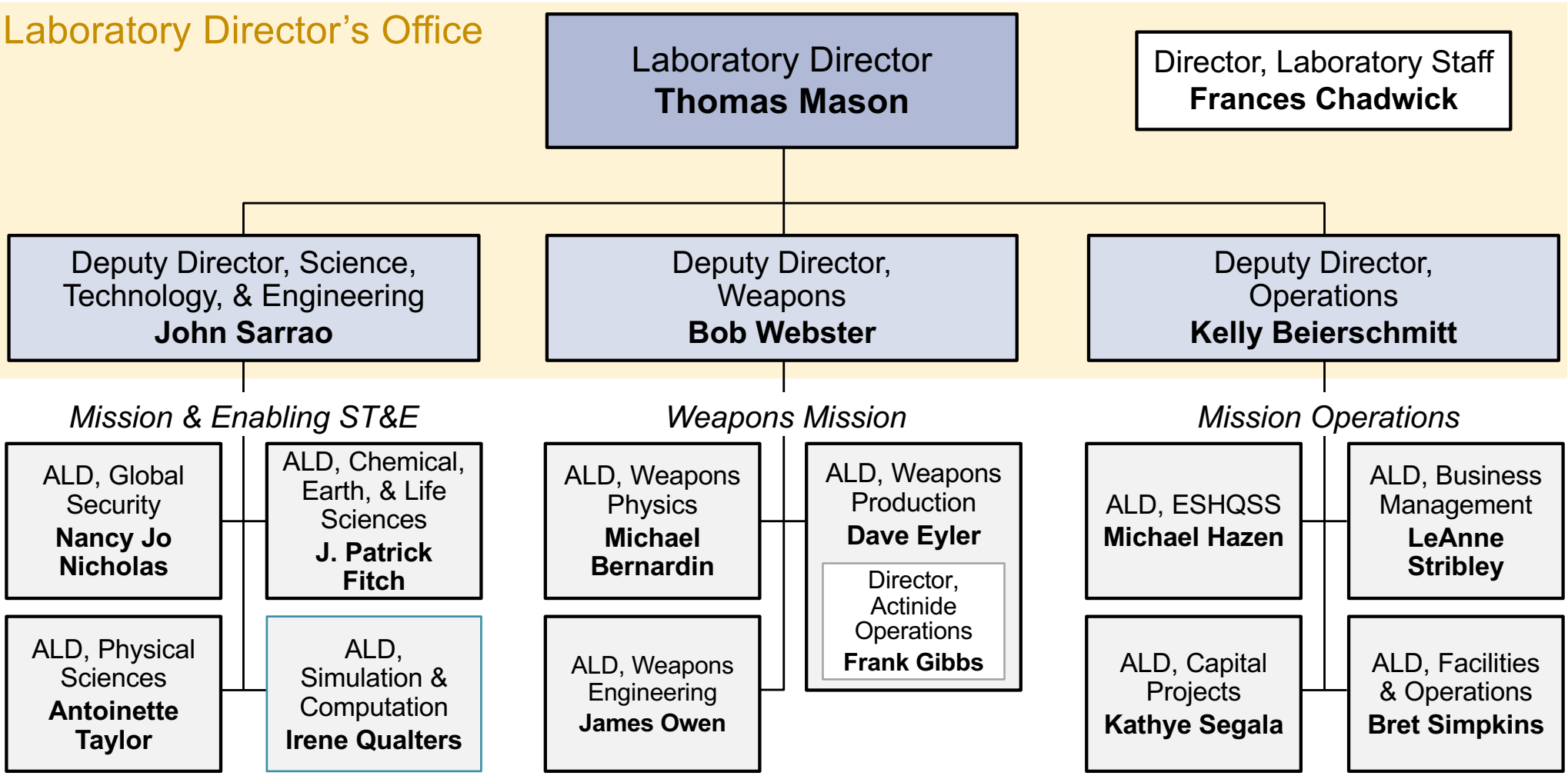
- Opportunity: Budgets, strong LANL capabilities, overlap with national security capabilities

Nuclear energy

- Opportunity: Partnerships, nuclear materials and reactor design capabilities, synergy with core missions

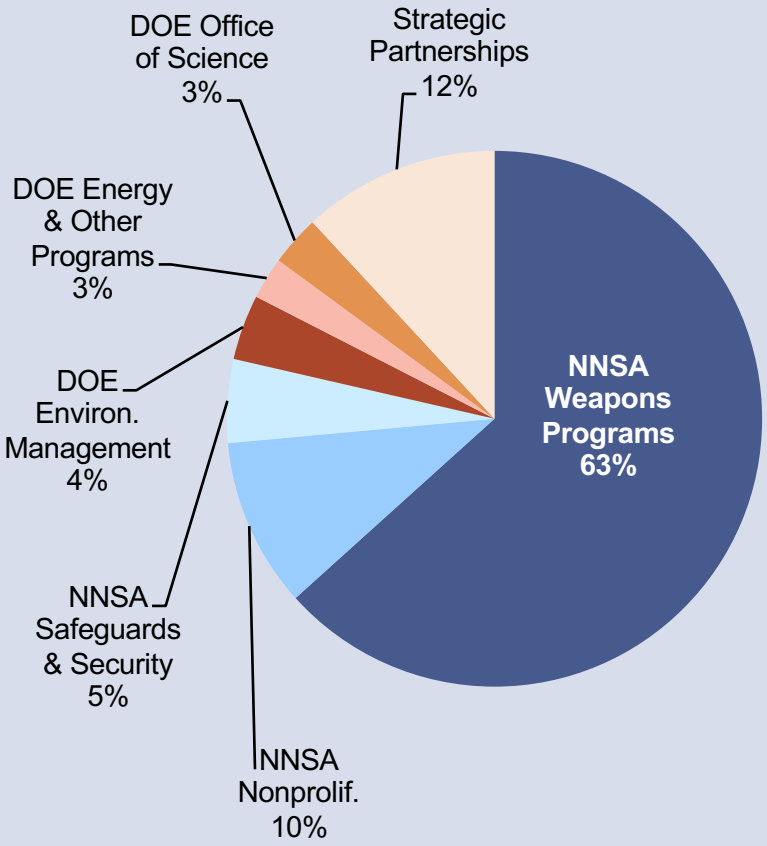
LANL's energy security strategy leverages core capabilities to address national needs

Los Alamos National Laboratory Organizational Structure



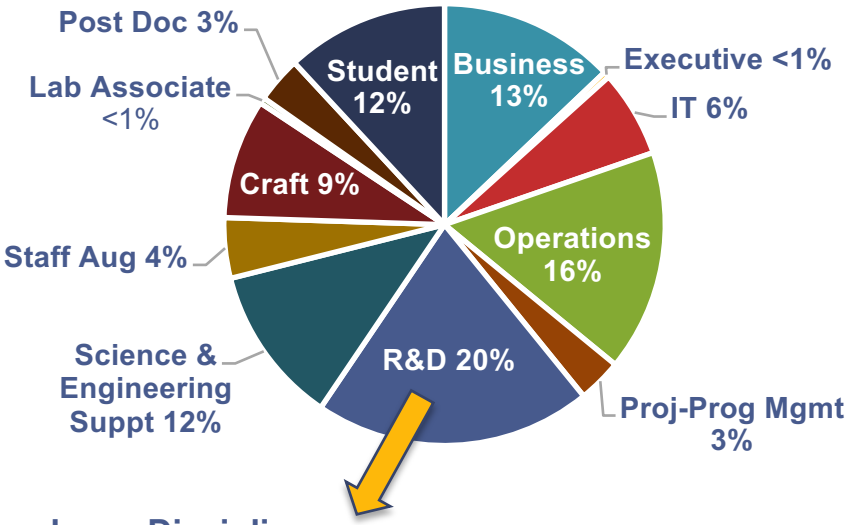
As a National Security Laboratory, applying multidisciplinary capability is inherent in our broad funding and workforce base

FY18 Estimated Budget Authority: $2.6B

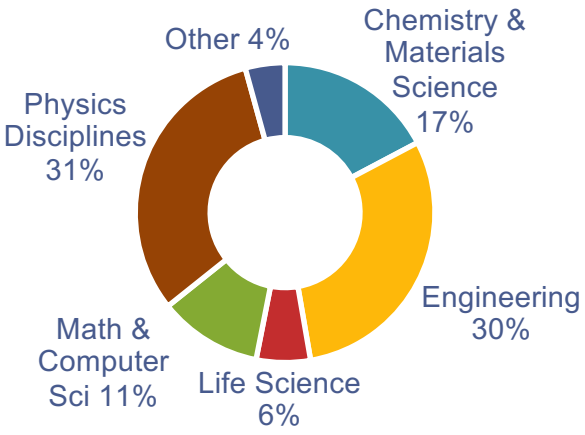


Approx. 12,000 National Security specialists collaborate in a wide variety of technical disciplines

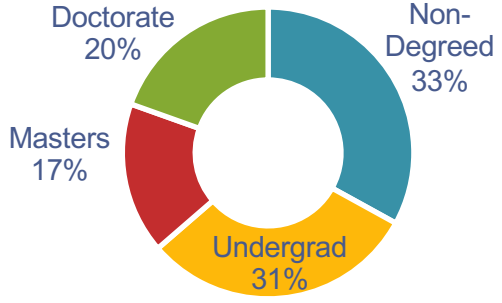
Employee Categories



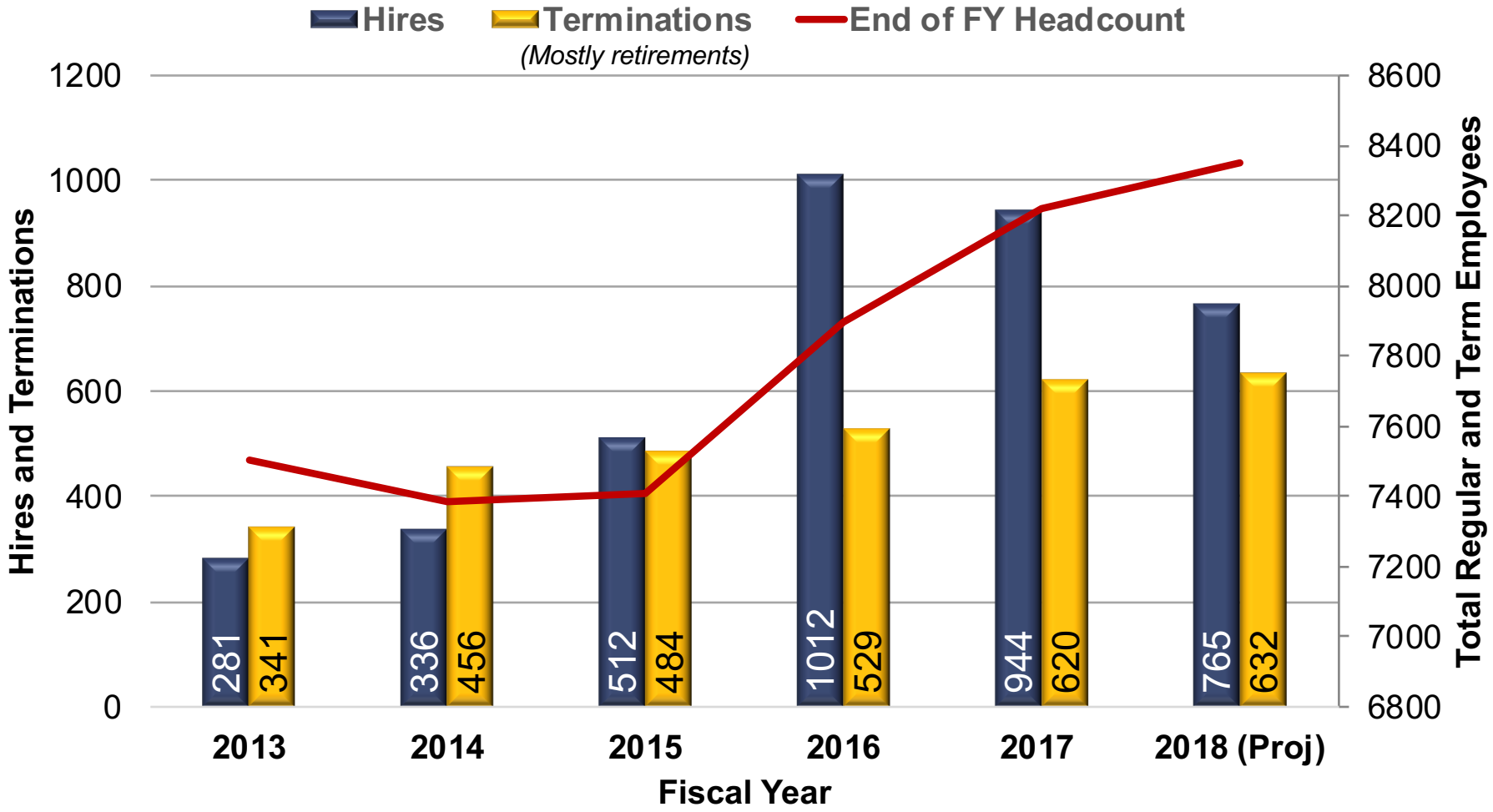
R&D Employee Disciplines



Degreed Workforce

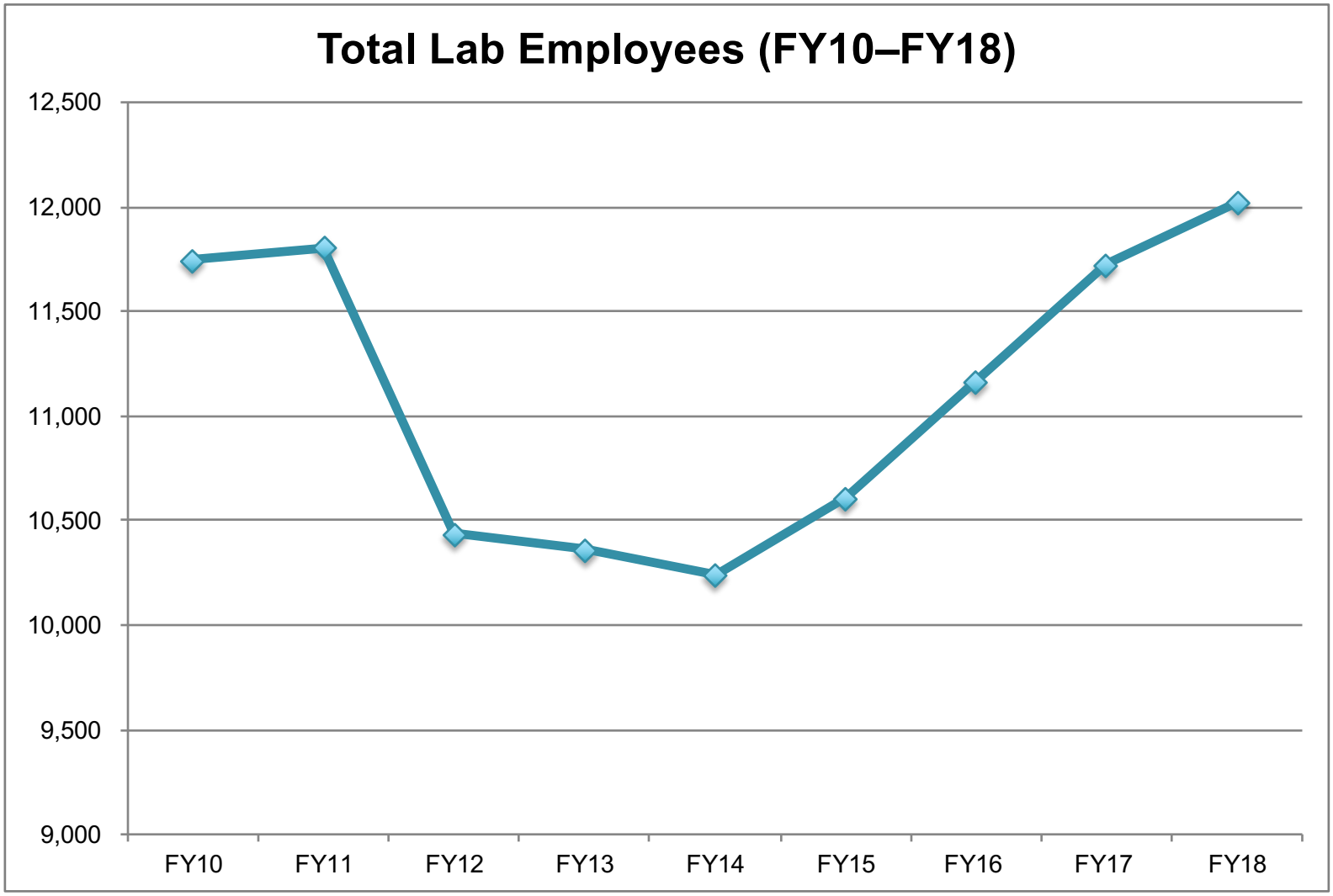


Attracting and retaining a quality workforce is vitally important to the future of the Laboratory



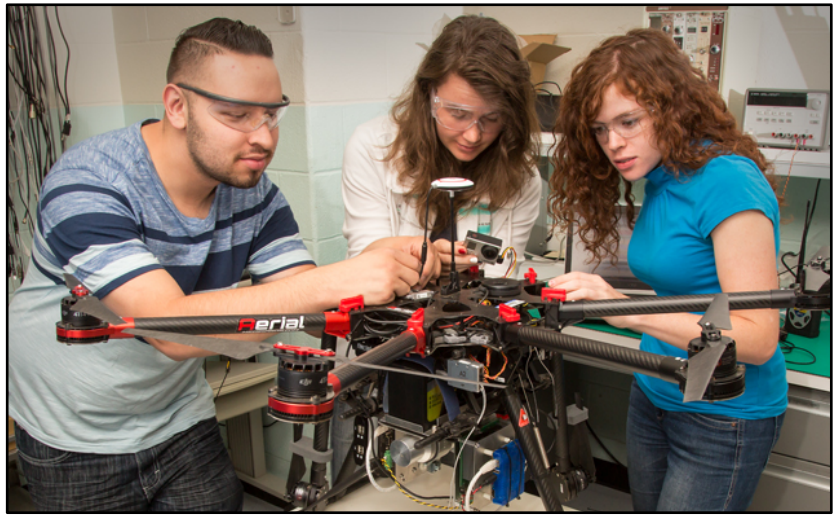
Based on FY18 hiring plans and initial attrition projections, LANL will increase by 133 people in FY18 to a total of 8,351

Attracting and retaining a quality workforce is vitally important to the future of the Laboratory



Healthy student and postdoc programs are vital to the Laboratory's early-career pipeline

- **Each year, more than 1,800 students and 400 postdocs work at Los Alamos**
- **Conversion of postdocs to technical staff is our most highly utilized early-career pipeline**



Percentage of total LANL population in FY17 who were former students or postdocs

36%	61%	33%
All LANL employees (Reg, TRMA)	All R&D scientists & engineers	Managers

Percentage of new hires in FY16 who were former students or postdocs

17%	52%	73%
All new hires	All R&D hires	Non-mgmt PhD tech staff hires

DRAFT 2019 LANL Laboratory Agenda: Emphasis on Simultaneous Excellence

Strategic Objectives	Excellence in Nuclear Security	Excellence in Mission-Focused STE	Excellence in Mission Operations	Excellence in Community Relations
Critical Outcomes	**Design, produce, and certify current and future nuclear weapons and reduce global nuclear threats**	**Deliver scientific discovery and technical breakthroughs that support DOE/NNSA missions**	**Execute sustained operations that are reliable and responsive to mission needs**	**Sustain and enhance LANL's partnership with the community across the Northern New Mexico region**
Major Initiatives	• Execute LANL's manufacturing mission to deliver 30+ plutonium pits per year • Transform nuclear weapons warhead design and production • Develop and deploy revolutionary tools to detect, deter, and respond to threats to global security • Achieve First Production Unit (FPU) and Last Production Unit (LPU) for the W88 ALT 370, B61-12 LEP, and ALT 940	• Refresh and refine the LANL capability pillar framework – Materials for the future – Science of signatures – Integrating information, science, and technology (IST) for prediction – Nuclear and particle futures – Complex natural and engineered systems • Advance accelerator science, engineering, and technology to enable ECSE → MaRIE and related capabilities • Advance the frontiers of computing to exascale and beyond • Assert leadership in the national quantum initiative • Develop and implement an integrated nuclear energy and materials initiative	• Achieve culture change with an emphasis on organizational learning • Improve integrated planning across priority mission activities and infrastructure • Address critical issues related to NMC&A, nuclear safety, criticality safety, and waste operations • Implement systematic process improvement to drive increased rigor and efficiency in work execution • Enhance quality of work life, workforce planning, and training and development	• Institute a personal commitment to community service by LANL leadership • Engage in mission-centered workforce and pipeline development • Enhance small business participation in executing LANL scope across all directorates • Implement a Community Commitment Plan to provide educational, economic development, and philanthropic support to the surrounding community

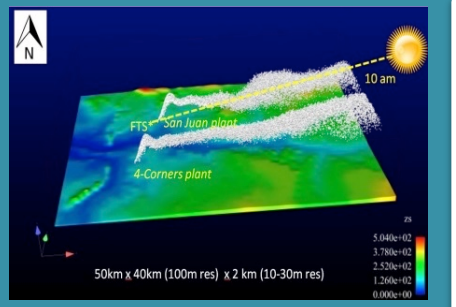
Four capability pillars define key areas of science, technology & engineering in which we must lead

Materials for the Future

Defects and Interfaces

Extreme Environments

Emergent Phenomena

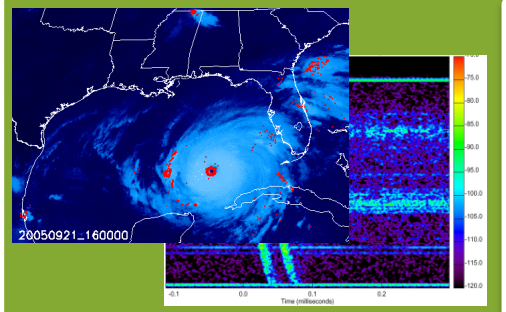


Science of Signatures

Discover Signatures

Revolutionize Measurements

Forward Deployment

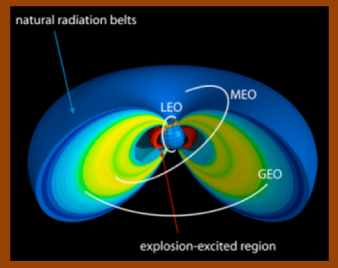


Integrating Information, Science, and Technology for Prediction

Complex Networks

Computational Co-Design

Data Science at Scale



Nuclear and Particle Futures

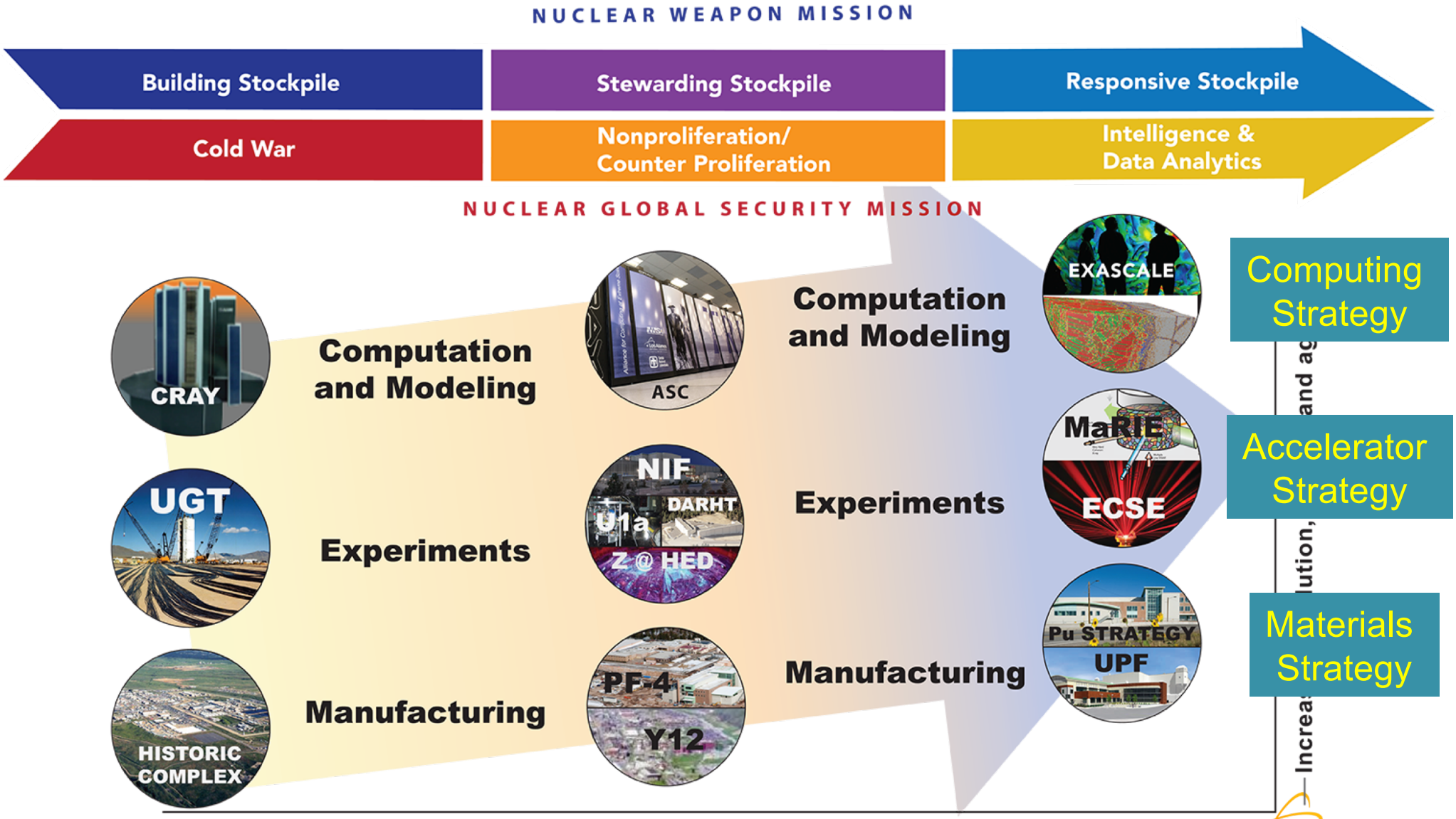
High Energy Density Physics & Fluid Dynamics

Nuclear & Particle Physics, Astrophysics & Cosmology

Applied Nuclear Science & Engineering

Accelerator Science & Technology

We see an enduring future for an integrated Laboratory
— and the need for integrating assets at scale for national security



Integrating IS&T for Prediction is a cross-cutting pillar, leveraging the frontiers of computing

Materials for the Future Pillar

Science of Signatures Pillar

Nuclear and Particle Futures Pillar

IS&T Pillar

Computational Co-Design

Applied Computer Science
Computational Mathematics
Computational Physics
Novel Computing
Simulation Science

Data Science at Scale

Image and Signal Processing
Machine Learning
Statistics and UQ
Data Visualization and Analytics

Complex Networks

Biological & Social Systems
Infrastructure Science
Cybersecurity and Cyberphysical Systems
Graphical Models

Underpinning High Performance Computing

LANL has a multi-faceted Quantum Strategy that is synergistic with SC

- Science Frontiers
- "Co-Design"

ASCR	BES	HEP	NP
Quantum algorithms; uncertainty quantification and verification & validation methods; software stack; quantum networks	Synthesis, characterization, theory, modeling, and instrumentation to advance quantum materials & chemical phenomena	Black hole physics; quantum gravity and quantum error correction; fundamental aspects of entanglement	Isotopes and trapped ions for quantum devices; lattice quantum chromodynamics

Quantum Field Theory and Topology

Control of Quantum Phenomena

HEP, NP: theory, fund physics, detectors
BES: matls ➔quantum; quantum ➔matls
ASCR: quantum algorithms & testbeds

SC

Ising

ASC

WFO

- Bleeding Edge Technologies
- Mission Needs

- Novel Hardware
- Vendor Access

Institutional Investment
- Competitive LDRD; Early Career Awards
- Rapid Response Efforts; Summer Schools

Our materials strategy supports our national security mission and is strongly aligned with BES priorities

GOALS

Performance Prediction and Controlled Functionality

SCIENCE THEMES

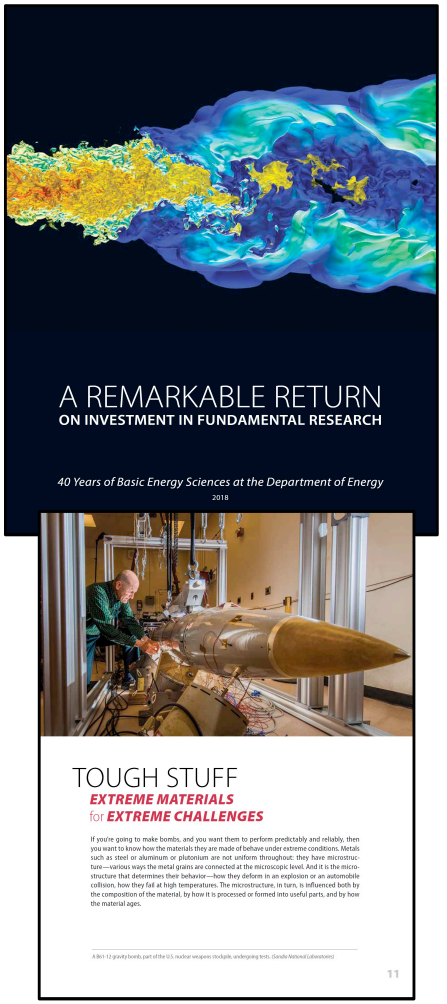
Defects and Interfaces

Extreme Environments

Emergent Phenomena

AREAS OF LEADERSHIP (AoL)

Complex Functional Materials	Material Resilience in Harsh Service Conditions	Manu-facturing Science	Actinides & Correlated Electron Materials	Integrated Nano-materials	Energetic Materials	Materials Dynamics



Our newest AoL: Performance certification & process modeling is a key challenge

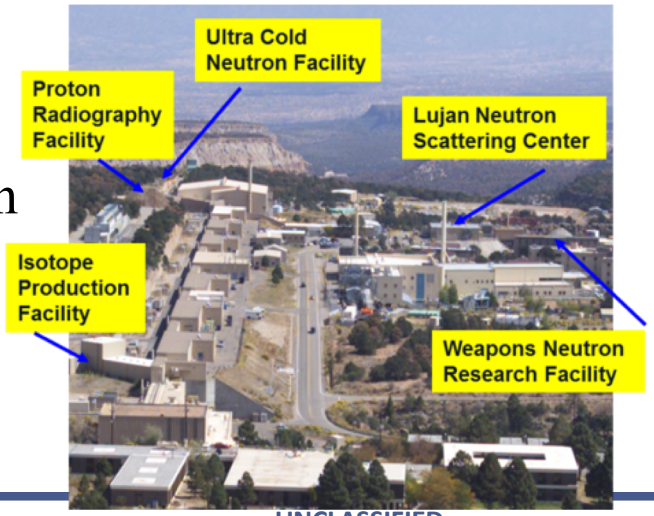
National User Facilities (both local and international) are key venues for collaboration and community engagement

Materials Research @ LANL

NHMFL-PPF:
Research with high magnetic fields

LANSCE
Los Alamos Neutron Science Center

Research with protons and neutrons



LCLS

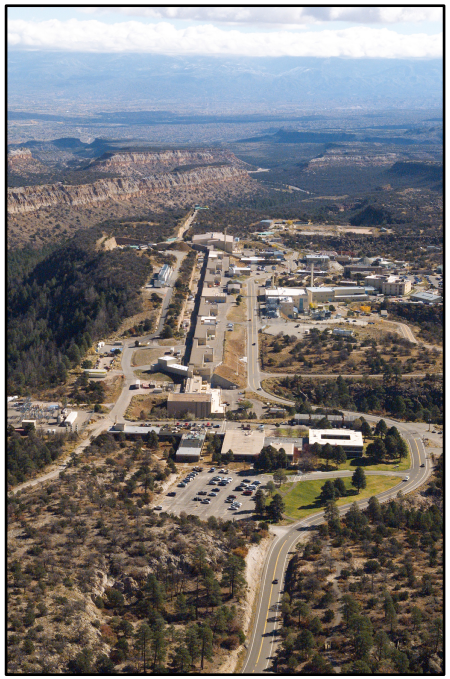
Advanced Photon Source

SNS
SPALLATION NEUTRON SOURCE

LANSCE is a key resource for materials and nuclear science and the foundation for MaRIE

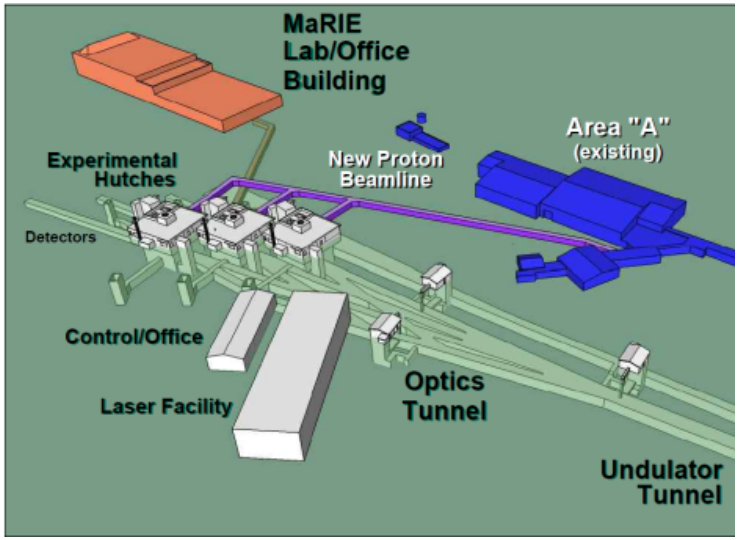
LANSCE

- Operations began in 1972
- 800 MeV (1 MW) proton beam
- Highly capable/flexible facility
  - 100–800 MeV proton energies
  - 5 target stations; 16 beam lines
  - Flexible time structure
- Dynamic proton radiography
- Neutron scattering and radiography
- Fundamental physics
- Nuclear cross sections
- Isotope production



MaRIE will provide a transformational materials capability facility for NNSA mission needs:

- World's highest energy x-ray scattering capability (42-keV XFEL) and high repetition frequency with simultaneous charged particle dynamic imaging
- **Unique capability for simultaneous, multi-probe measurements of in situ transient phenomena in relevant dynamic extremes with microstructure resolution**



- **CD-0: March 2016**
- **FY17 Milestone: "MaRIE Requirements Review"**
- **FY18 Analysis of Alternatives: Pending**

LANL is *the* NNSA Accelerator Lab

- **Accelerator technology is a backbone of our deterrent in the absence of nuclear testing**
  - Penetrating radiography at DARHT and ECSE are the new “admiral’s test”
  - Experiments performed at LANSCE provide the underpinning material and nuclear science needed to accurately model nuclear weapons
  - MaRIE will address specific NNSA Mission Needs
- **Our accelerator strategy invests in our current facilities and builds the next generation facilities**
- **The success of Scorpius and MaRIE relies upon the people working at DARHT and LANSCE**
- **We believe that a formal partnership framework between SC and DP and their Laboratories would be mutually beneficial**
  - Projection execution assistance: SNS, LCLS, …
  - Technical peer assessment: Independent Review; Best Practices
  - Coordinated LDRD investment, facility access

The Laboratory's complexity is essential for mission solutions

- Los Alamos delivers national security mission solutions
  - using multidisciplinary science, technology & engineering
    - through an integrated approach that harnesses the strength of our people, capabilities, and operations

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